ALEXANDER STEPANOVICH POPOV

ARTICLES ABOUT THE SCIENTIST

On the approaches to the invention o

The invention of the radio was prepared by the development of science and technolo using “electric waves” to create a wireless connection literally hung in the air. The pı he reported on the experimental receipt of electric waves predicted by M. Faraday a Maxwell, gave a new impetus to the practical solution of this problem. Some scientis phenomenon of induction, while others - on the phenomenon of the propagation of

- 1886 - the magazine "Electricity" announced the invention of T.-A. Edison me induction [1, p. 71].
- 1888 - Professor of St. Petersburg University I.I. Borgman, using the Rumkor the spread of electricity through the air to a distance of 19 m [1, p. 72].
- 1892 - an English physicist and chemist W. Crookes published an article in a the possibility of using electromagnetic waves for wire-free telegraphy by dire specific wavelength.

Many others wrote about the possibility of using Hertz waves to transmit signals, bu scientific ideas was progressing slowly. If the Hertz vibrator, which was based on the winding of the induction coil, could serve as a sufficiently powerful emitter of electro - a coil of wire with an air gap - as a receiver was imperfect and suitable only for lab

The first in the search for an effective indicator of electromagnetic waves of success Branly. Carrying out experiments with electricity, he noticed that during a spark disc metal filings poured onto a glass plate drops sharply. Using this phenomenon, E. Bra which he called a radio conductor. The radio conductor made it possible to judge the by the deflection of the galvanometer needle in its radio conductor circuit, but at the restore it, the radio conductor had to be shaken [1, p. 75].

To one degree or another, N. Tesla, D. Mincin, O. Lodge, A. Riga, F. Brown, A. Slaby, course, A. S.Popov (since 1889). Some of them set themselves the task of creating communication. N. Tesla worked on the transmission of both meaningful signals and substantially improved the Hertz vibrator [2, p. 232].

The British physicist O. Lodge was able to take the most important step in this area, which he described in his lecture in memory of G. Hertz in 1894. The Lodge noticed that two balls located close enough to each other when the sparks slipped between them came close to such a distance, that between them there could pass enough current for the action of the electric bell. Lodge explained this phenomenon by the f that under the influence of an electric spark, cohesion (cohesion) of the balls occurs. Soon he created a device resembling the radio conductor E. Branly and representing a glass tube filled with metal filings. Lodge called this device the coherer. He placed the coherer on the same board with the bell. When the bell rang, board began to vibrate, the coherer was shaken, and its sensitivity to the arrival of next signal was restored. However, O. himself The lodge was aware of the imperfect of this construction. He wrote: “It is possible that an electric bell located so close to coherer’s duct is not the best way to restore the coherer's sensitivity.” Nevertheless, report of the Lodge made a noticeable impression on scientists, including A.S. Popov. The Russian scientist began to look for a more effective way to restore the sensitivity of the coherer.

At one of his lectures, repeating the experiments of Hertz, AS Popov in 1889 said: “ a sensory organ that would notice electromagnetic waves in the ether; if we could in replace electromagnetic feelings for a person, then it could be used in transmitting electromagnetic waves. ” These words indicate that since 1889 he reflected on the p waves in order to create a wireless communication system - for the developing Russ his teaching activities in the mine officer class of the Baltic Fleet in Kronstadt.

Invention by A.S. Popov of a wireless teleg

In 1893, the World Exhibition opened in Chicago. The Marine Technical Committee s A.S.Popov to this exhibition as a specialist in the use of electricity. At an exhibition i Chicago, Popov got acquainted with the best examples of electric machines, studied teaching of electrical engineering in New York and San Francisco, got acquainted wit work of the power plant on Niagara. But most of all, the attention of the Russian professor was drawn to American work on the use of electric current.

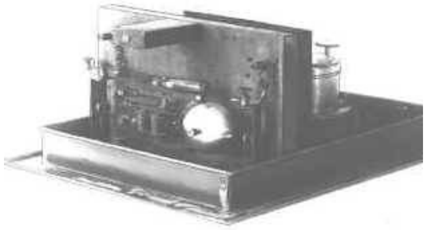
Before his trip to Chicago, A.S. Popov during the winter of 1892–1893. created a sufficiently powerful transmitter for the wireless telegraph system he is developing f Russian Navy. The transmitter was created on the basis of the Hertz vibrator, with a induction coil, a spark gap in a vessel with oil and with an antenna in the form of tw square metal sheets with a side of 40 cm.

As an element sensitive to radio emission, Popov proposed the Branly – Lodge coherer. But unlike Lodge, he applied the call not as a passive shaker of the coherer receiver circuit: the hammer, striking the cup of the call, fixed the signal reception, the coherer, thereby ensuring the system was ready to receive the next signal.

The wireless telegraph system was repeatedly tested in the spring of 1895 in the ga radio communication range was 30–40 fathoms, i.e. 60–80 m. Only after that A.S. I meeting of the Physical Department of the Russian Physicochemical Society (RFHO)

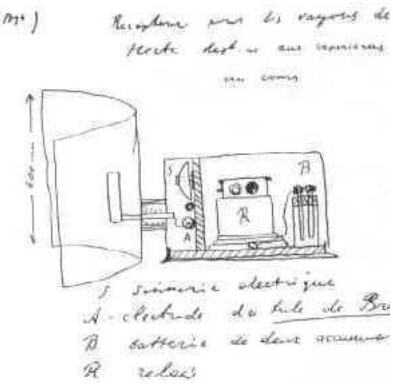
At this meeting, he carried out the world's first radio communication session with the transmission and reception of long and short signals - elements of Morse code - and their fixation by the receiver's bell. He noted that a receiver with an antenna in the form of a vertical wire 2.5 m long “answered” in the open air to vibrations produced by a large hertz vibrator at a distance of 30 fathoms (64 m). A.S. Popov concluded his report with the words: “In conclusion, I hope that my device <...> can be applied to transmitting signals over distances using fast electrical vibrations, as soon as a source of such vibrations with sufficient energy is found ”[3, p. 70].

The protocol of the RFHO meeting (see “Journal of the RFHO”, 1895, No. 8) contains a description of the receiver, according to I.V. Brenev, “allowing any electrical engineer to reproduce it without difficulty” [4]. The first printed message about the invention of A. S. Popov appeared five days after his report in the newspaper Kronstadt Bulletin dated May 7, 1895 [5]. AS
Popov set forth the essence of his invention in a detailed article written in December
issue of the Journal of the RFHO (1896), which had an international mailing list, and
(1896, No. 13 –14) and the Meteorological Bulletin (1896, No. 3). Abstracts of the a
foreign journals [3, p. 70]. In the first article, A.S. Popov emphasized



The first radio receiver in the world, which A.S.Popov demonstr
at a meeting of the Physical Department of the RFHO on April 25 (Ma

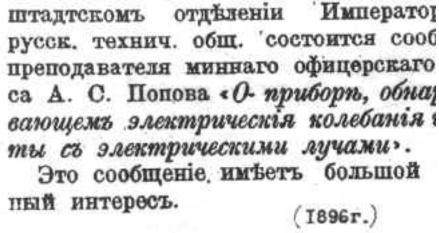
Later A.S.Popov further defended his priority in the invention of radio in an article p
(December, 1897).



Hand-drawn sketch of A.S.Popov receiving device,
which he demonstrated during a report on March 12 (24), 18

The receiver circuit of A.S. Popov is shown below. The tube of the coherer AB was s
clamps M and N on a light clock spring, which for greater elasticity was bent at one
M; the bell was positioned so that the hammer could make light strikes in the middl
rubber ring was put on to avoid breakage. The tube and bell were fixed on one verti
automatically restored the coherer's ability to receive the next information signal.

To ensure reception of even weak signals, a sensitive telegraph relay was introduce



Въ пятницу, 19-го января, въ
штадтскомъ отдѣленіи Императо
русск. технич. общ. состоится сооб
преподавателя миннаго офицерскаго
са А. С. Попова «*О приборѣ, обна
вающемъ электрическія колебанія
ты съ электрическими лучами*».
Это сообщеніе имѣетъ большой
ный интересъ.
(1896г.)

Announcement in the Kronstadt Gazette No. 7 of January 17, 1

A relay with a power source (4–5 V) could be placed anywhere. Current flowed cont
the electrode P to the coherer platinum plate A, then through the metal powder in t
plate B and through the relay winding back to the battery electrode Q. The strength
attract the relay armature, but when, under the influence of an electromagnetic sig
decreased as a result of sintering, the current increased so much that the armature
section of the circuit from the battery to the bell, previously opened at point C, clos
was attracted, and the hammer connected with it hit the bell. However, immediately
at point D, and during the reverse stroke the hammer knocked on the coherer's tub
the circuit, and the relay opened the bell circuit. After that, the system was ready t
until all information was received.

The fact that the receiver of A.S.Popov was intended for the wireless telegraph syst
his article: “The receiver responds to single oscillations with a short call; continuous
[transmitter. - IM] they respond to the receiver quite frequently, at approximately e
calls ”[3, p. 65]. So the dots and dashes of Morse code were transmitted.

When installed in March 1896 at the output of the receiver of the Morse apparatus, the dots and dashes were clearly fixed on the telegraph tape.

In his article of 1896, Popov also noted that his receiver of a telegraphy system without wires can be used as a "light detector". Immediately after the historical report, in June 1895, he created a meteorological device, called meteorologists as the discharger of A.S. Popov, and later - as Popov lightning detector. But this was a second, separate invention based on the scheme under discussion. Instead of the Morse apparatus, a new device was installed in the new device for the Richard brothers to automatically record lightning discharges on the tape of the recorder. A.S.Popov installed his lightning detector at the Forest Institute meteorological station to accumulate data on the frequency and strength of lightning discharges, which interfere with radio reception.

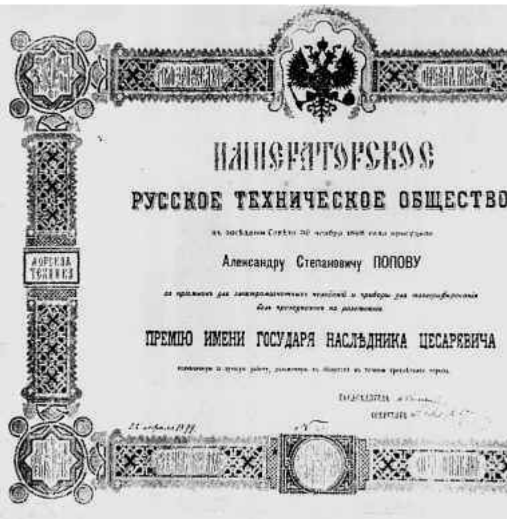
It took A.S.Popov a year to increase the range of radio communication to an accepta
view. He improved his transmitter: increased its power, installed at the output, as w
antenna, as well as a Morse apparatus for fixing signals on a telegraph tape.

A.S.Popov demonstrates the reception of the world's first radiogram "H
on March 12 (24), 1896 (From the book "At the Origins of Radio Communication" by S

With an improved wireless telegraph system A.S.Popov spoke at a meeting of the Ph
March 12 (24), 1896. This time, he transmitted and received the world's first radiog
radio distance of 250 m. Telegraph a tape with this text was kept for a long time by
prof. V.K. Lebedinsky until she died with his library in Riga during the First World Wa

The report of A.S. Popov on March 12 (24), 1896 was an additional confirmation of
because was made pending the patent of G. Marconi.

The essence of this report was not disclosed in the minutes of the RFHO meeting, be
connection with the development of a new wireless telegraph system for the develop
was said in the protocol: "A.S. Popov shows instruments for lecture purposes" [3, p.
by E.G. Kyandskaya-Popova, I.D. Morozov, "On the Question of the First Radiogram
in Physics No. 12/01).



ИМПЕРАТОРСКОЕ

РУССКОЕ ТЕХНИЧЕСКОЕ ОБЩЕСТВО

Александру Степановичу ПОПОВУ

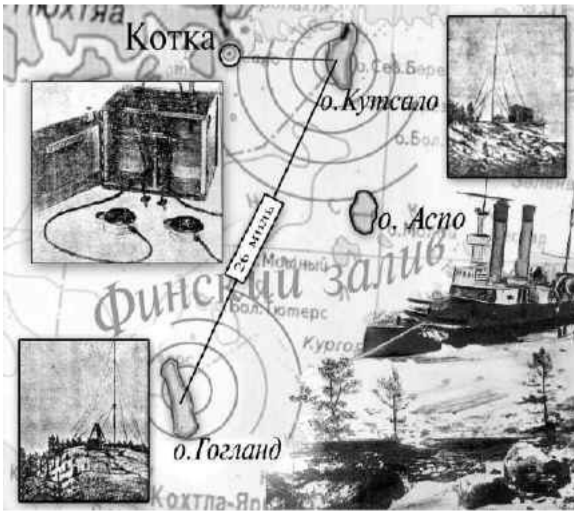
ПРЕМІЮ ИМЕНИ ГОСУДАРЯ НАСЛѢДНИКА ЦЕСАРЕВИЧА

RTO diploma on awarding A.S.Popov the Prize named after Sovereign Hei
for the invention of a telegraphy system without wires, November

The equipment of A.S.Popov from 1897 began to be used first in the Baltic Fleet, an
March 2, 1899, in a report by Vice Admiral I.M. Dikov to Admiral P.P. Tyrtov, Directo
of the A.S. Popov radio communication system in the Black Sea Fleet, it was said: "
on September 3 .Popova was the only means of communication between the ships a
reaching a communication range of up to 30 nautical miles [more than 50 km. - I.M

In 1899, A.S. Popov, together with P.N. Rybkin and D.S. Troitsky, first tested radio c
May 1899 they tested the radio communication system between Kronstadt forts. Du
coherer "detector effect" on the radio, which allows them to receive information "by
Popov at that time was on a business trip abroad, but, having received a telegram,
the open "detector effect". After conducting thorough research, he developed three
telegraph signals to headphones ("by ear"), which allowed to significantly increase t
and created a scheme for a special telephone receiver. He filed a patent application

A.S.Popov was granted the Russian privilege for a telephone receiver with internatic
November 30, 1901. This was the third invention of A.S.Popov, also patented in Eng



The world's first practical radio communication line between S. Kopso and
(telephone receiver of A. S. Popov, which received Russian privilege, as well as French a
image; radio station on Gogland Island (lower left snapshot

In the fall of 1899, the battleship “Admiral General Apraksin”, due to the navigationa
stones off the island of Gogland in the Gulf of Finland. Gogland had no telegraph co
mainland. Spring ice drift could move the battleship from its place and thereby caus
perhaps even lead to death. It was necessary to take urgent measures to remove th
a telegraph connection with the mainland was needed. Cable routing in the winter w
establish a connection with the island using A.S.Popov’s wireless telegraph system.
station on the island of Kutsalo, located near the coast, which had contact with it th
which, in turn, was connected by a telegraph line to St. Petersburg.

They decided to install a second radio station on the island of Hogland, near the bat
crashed. It was the world's first practical radio link with a communication range of 4
winter of 1900, in harsh conditions, the construction of both radio stations equipped
Popov radio equipment was completed. This radio line is often called the Gogland-Ko
line. It is interesting to note that the first on this line was a radiogram from the Mai
Headquarters
(St. Petersburg) to the icebreaker "Ermak", standing next to the battleship, with the
follow at sea to rescue fifty fishermen who were on the ice on the open sea. This wo
radiogram to save people went down in the history of radio communications. The ice
Yermak complied with the order, and the fishermen were rescued. The radio line co
work successfully until April 1900, until the completion of work to remove the battle
stones.

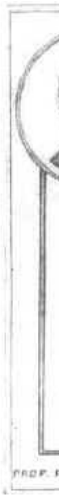
AS Popov made a report on the operation of this radio line at the IV International El
Congress in Paris, which was held in August 1900. The report said: “Over the course
440 official radiograms were exchanged. The longest was 108 words — the one that
broadcast with the announcement of the news that the battleship was saved ... I be
service was the first in which telegraphy without wires could thus serve regularly an
success ”[4, p. 108].

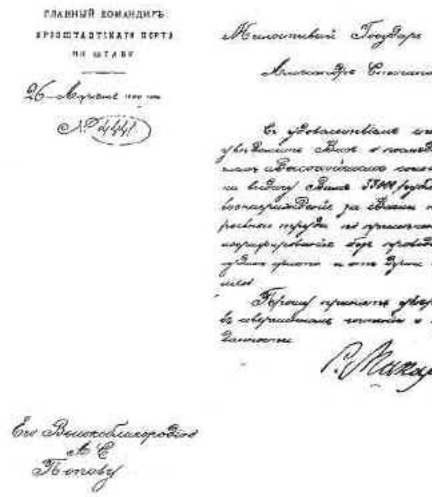
The Gogland-Kotka radio line served not only departments of the Ministry of the Sea
say that it was the first permanent radio line that laid the foundation for the civilian
with its help that the domestic and world press received information about the work

On March 7, 1900, the Maritime Scientific and Technical Committee (MNTK) sent a r
Ministry on the need to deploy radio communications equipment for ships, as well as
on radio communications equipment under the direction of A.S. Popov. The comman
Makarov, who patronized the work of A.S. Popov in the fleet, requested the award o
telegraph system for the Russian Navy. As a result, Popov received a reward
in the amount of 33,000 rubles, and his assistant P.N. Rybkin - 1000 rubles.

S.O. Makarov was the first to send a thank-you letter to the inventor with the following content: “Gracious sovereign Alexander Stepanovich! I am pleased to hasten to notify you of the ensuing highest permission to issue you 33,000 rubles as a reward for your continuous efforts to create and use wire-less telegraphy on ships of the fleet and sincerely congratulate you. Please accept the assurances of perfect reverence and devotion. S. Makarov. ”

In 1901, the American businessman Dr. Goring visited A.S. Popov in Kronstadt. In response to the guest’s request, A.S.Popov gave him a diagram of his receiver for his wireless telegraph system with a description, as well as photographs of the receiver, lightning detector, and his own.





Letter from Admiral S.O. Makarov to A.S. Popov with congratulations on the oc

Based on these documents, Dr. Goring created his own version of a wireless telegra
miles (about 500 km) and soon sent a letter of thanks to Popov: “My dear professor
invention. It will be published soon ... We will immediately seek to ensure that your
inventor of the first wireless telegraph are set before the whole world ... And Marcon
as an imitation of the creative train of thought of the inventive genius of Professor A
memorial museum-apartment of A.S. Popov in St. Petersburg.)

Dr. Goring's article was published in the American newspaper “The North American”
the newspaper was sent to A.S. Popov. In addition to the text about the invention, i
received - a radio receiver of 1896, a light detector of 1895, as well as a portrait of

Chief curator of the Central Museum of Communications. A.S. Popova in St. Petersb
"Telecommunication" on the basis of archival documents and layouts substantiated t

- a telegraph system without wires, a radio communication system, May 1895
- meteorological device “AS Popov's discharge detector - lightning detector”,
- telephone radio, November 1899;
- self-healing telephone coherer, January 1900;
- spark radiotelephone system (together with associate professor S.Ya. Livshi

A.S.Popov entered the history of science and technology as a talented scientist, tire
respected teacher - professor, talented organizer of scientific research. For more tha
research and construction in one of the most important areas - wireless telegraphy
the navy and army, as well as for civilian purposes, and prepared a galaxy of studen
and gave his inventions for the benefit of mankind.

The leading role of A. S. Popov in the invention of radio was highly appreciated by t
- the Government of the Russian Federation of May 11, 1993 No. 434 “On the prepa
anniversary of the invention of radio”. The decision notes the leading importance of
the priority of the Russian scientist, Professor A.S. Popov.

This anniversary date has been included by UNESCO in the calendar of memorable
under the auspices of UNESCO, the International Anniversary Conference dedicated
invention of radio was held in Moscow.

**Prof. I.D. Morozov, Research Institute of the Central Navy, St. Petersburg "
what G. Marconi got a patent for"**